Space Weather Technical Forecast

Issued on Wednesday, 17 July 2024 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-Class flares likely (R1-R2 radio blackouts).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been High, with the largest flare X1.9 at 16/1326 UTC originating from AR3738. There are now up to seventeen sunspot regions on the visible disc. The largest and most complex region remains AR3738, now approaching the western limb. The next largest region is AR3751, in the southeast, which has a delta region in one of the compact intermediate spots. AR3753 in the northwest is in an inherently unstable somewhat north-south magnetically aligned configuration, though is beginning to fade. AR3743 has a somewhat complex magnetic structure, with flux emergence to the rear of the trailing spots. All other regions are small and appear largely magnetically simple at present.

Despite the number of sunspot regions, no Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE and DSCOVR at L1, showed weak transient effects throughout. Wind speed gradually rose from background to slightly elevated, from 330 to 410 km/s. The density was mostly average. The interplanetary magnetic field (IMF), Bt, was mostly moderate, but strong between 16/0330-1030 UTC, with a peak of 17nT. The north-south variation was almost entirely positive and varied between moderate and weak, ranging from +12/-6nT. The phi angle was variable at first, becoming mostly negative (Away from the Sun) at 161330 UTC. Geomagnetic activity was Active initially (Kp 4) before becoming Quiet to Unsettled (Kp 2-3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at mostly background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels. The 24-hour fluence was below Active, with 1.02e6 integrated pfu observed at 17/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Further M-class flares are likely with a slight chance of isolated X-class flares, most likely from AR3738 and AR3751. This risk reducing from day 2 (18 Jul) as AR3738 rotates around the southwest limb.

Solar Wind /Geomagnetic Activity: No further Earth directed CMEs are currently expected. The fast wind from CH54/- is not expected at Earth, but there is a slight chance of an enhancement days 2 and 3 (18-19 Jul).

Geomagnetic activity is expected to be mostly Quiet to Unsettled, with a slight chance of Active or G1/Minor storm intervals days 1-3 (17-19 Jul) due to ongoing CME effects or should there be any fast wind enhancement from CH54/-.

Energetic Particles / Solar Radiation: High energy proton flux is most likely to remain at background levels, but with a slight chance of rising above the S1/Minor Storm threshold in response to any notable flares.

The high energy electron flux is expected to remain at background levels. This may change

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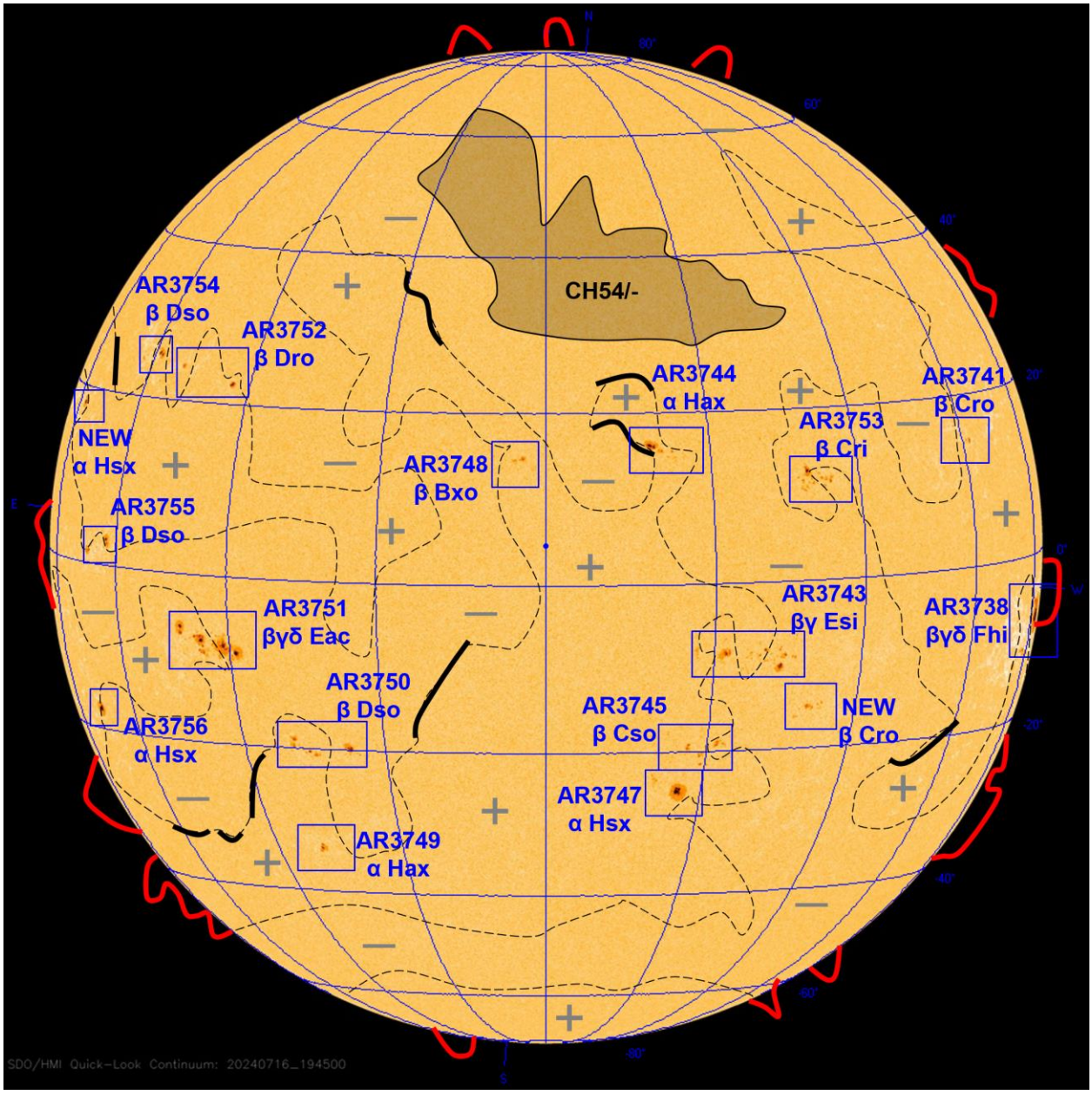
should the onset of any fast wind occur around day 2 or 3 (18-19 July). Any uptick in fluence may be experienced from day 3 or 4 (19-20 Jul) onward, though the expectation is to remain below the Active threshold.

Figure 1. Solar Analysis Valid 16/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

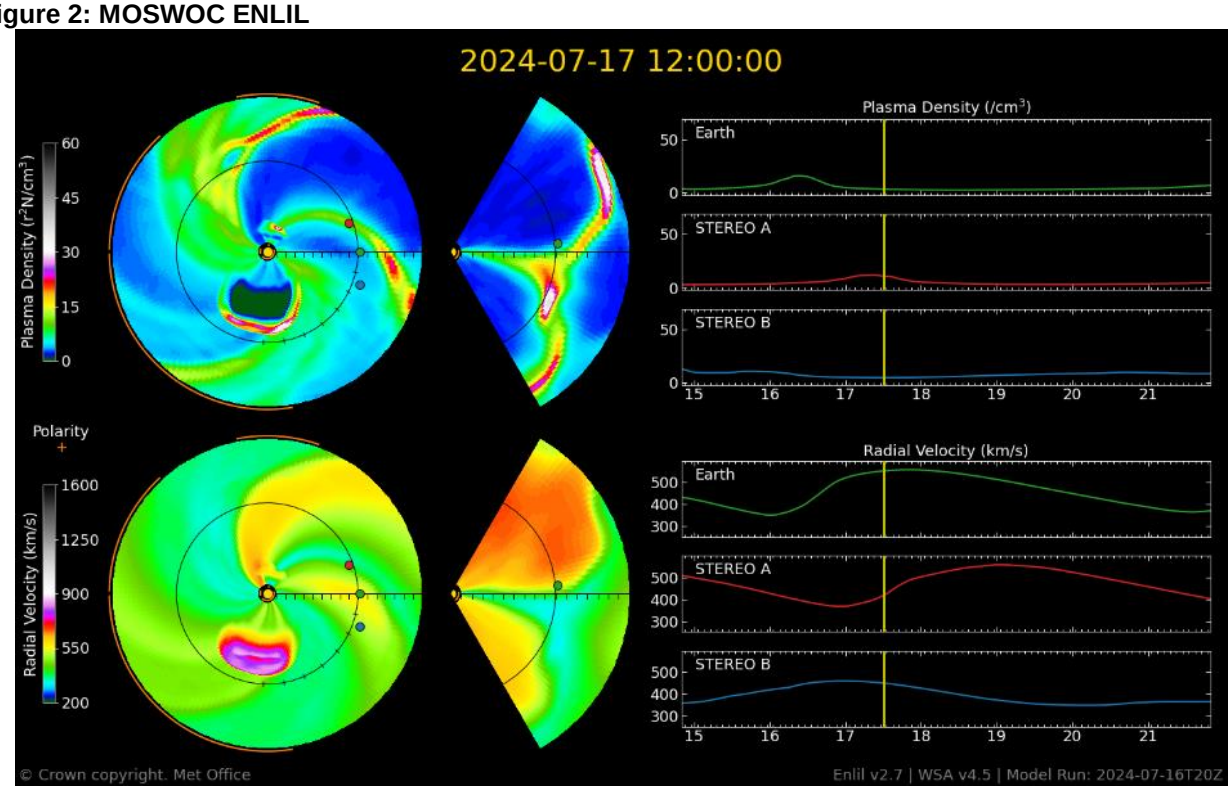
Earth appears to be experiencing weak ongoing CME effects, but no other Earth directed CMEs are currently expected.

The fast wind from CH54/- is something of an unknown as, although the CH was present on the last rotation, there was no obvious increase in wind speed from this feature. It is likely too far north to interact with Earth, though due to its size and apparent darkness, a token slight chance of a solar wind enhancement is catered for in days 2 and 3 (18-19 Jul). MOSWOC Enlil is almost anti-phase compared to expectations and very likely overstated in terms of magnitude.

Geomagnetic activity is expected to be mostly Quiet to Unsettled, with a slight chance of Active or G1/Minor storm intervals days 1-3 (17-19 Jul) due to ongoing CME effects or should there be any fast wind enhancement from CH54/-.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	10	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC ENLIL



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Radio Blackouts - X-Ray Flares:

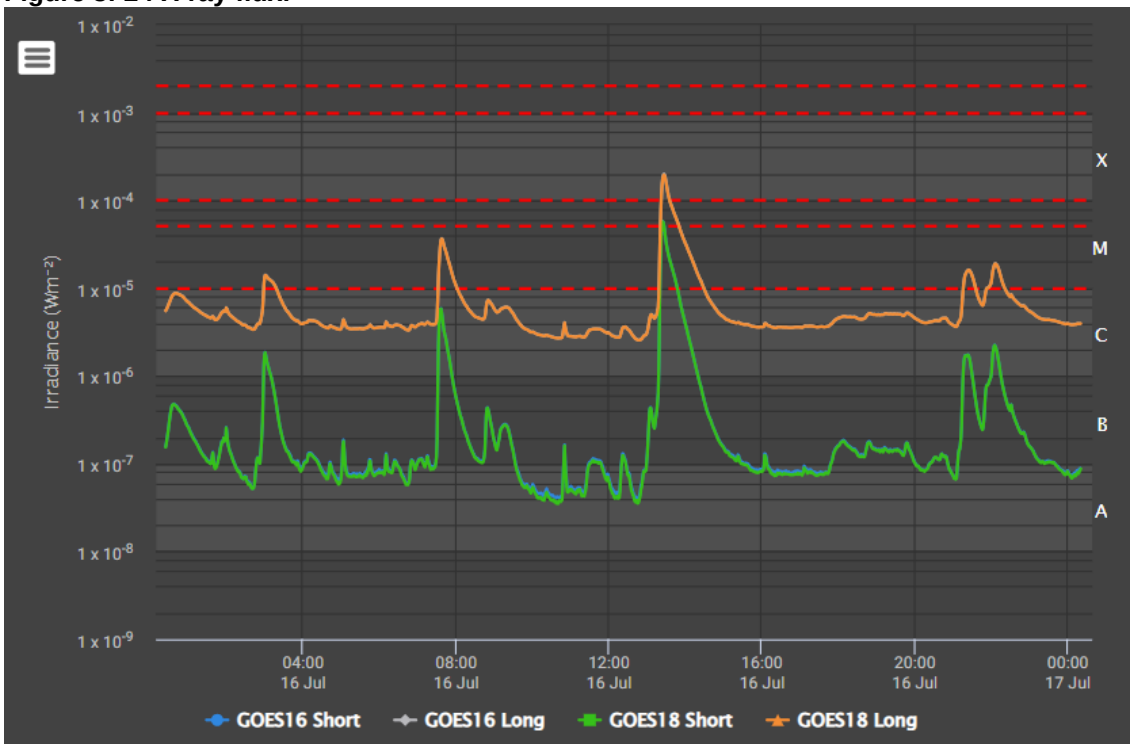
Solar activity has been High, with the largest flare X1.9 at 16/1326 UTC originating from AR3738.

There are now up to seventeen sunspot regions on the visible disc. The largest and most complex region remains AR3738, now approaching the western limb. It is getting difficult to assess as it approaches the limb, so the classification is being maintained as it rotates off. The next largest region is AR3751, in the southeast, which has a a delta region in one of the compact intermediate spots. AR3753 in the northwest is in an inherently unstable somewhat north-south magnetically aligned configuration, though is beginning to fade. AR3743 has a somewhat complex magnetic structure, with flux emergence to the rear of the trailing spots. All other regions are small and appear largely magnetically simple at present.

M-class flares are likely with a slight chance of another X-class flare. The most likely candidates for this are AR3738 and AR3751.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	70	60	60	60
Very Active	R3 to R5 X Class	No	15	5	5	5

Figure 3: 24 X-ray flux.



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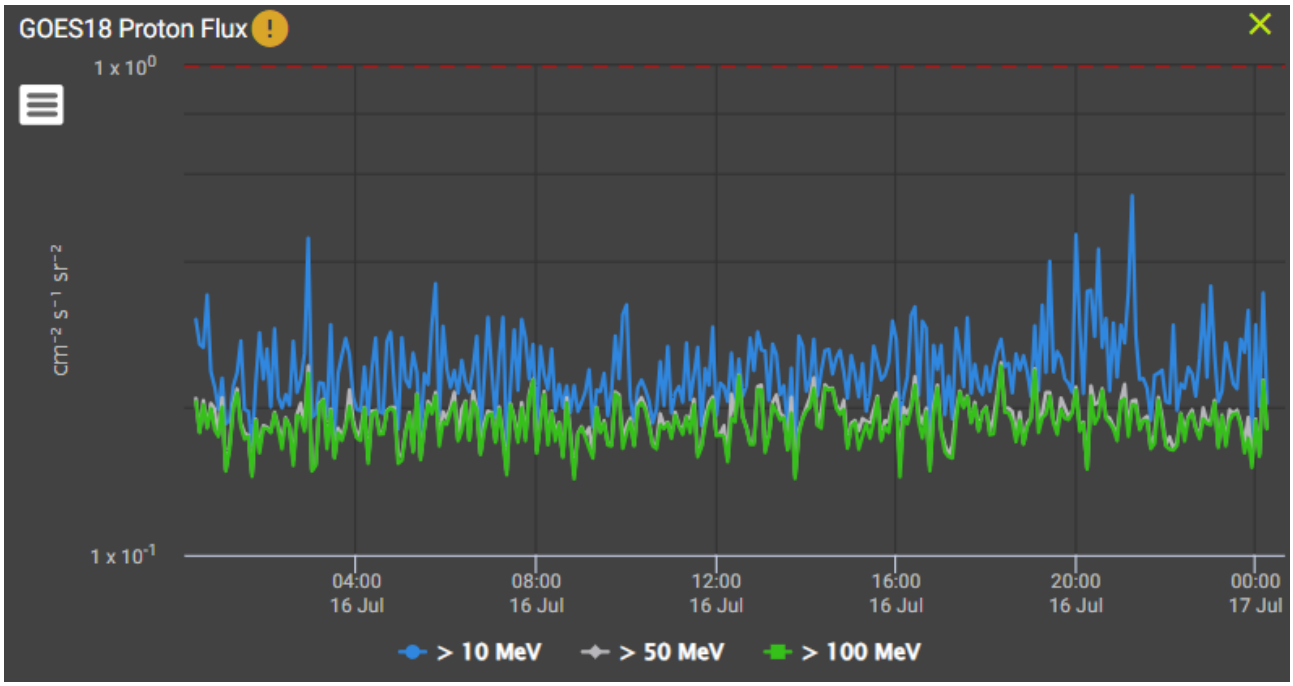
Solar Radiation Storms - (High Energy Protons):

High energy proton flux at GOES18 is at background levels. There remains a daily slight chance of exceeding the S1/Minor radiation storm threshold should any significant flares occur from AR3738 which is in a good location at present for solar radiation events to connect with Earth, though this spot has no history of proton rich flares. This risk reducing from day 2 (18 Jul) as AR3738 rotates around the southwest limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	15	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: 24 hour proton flux



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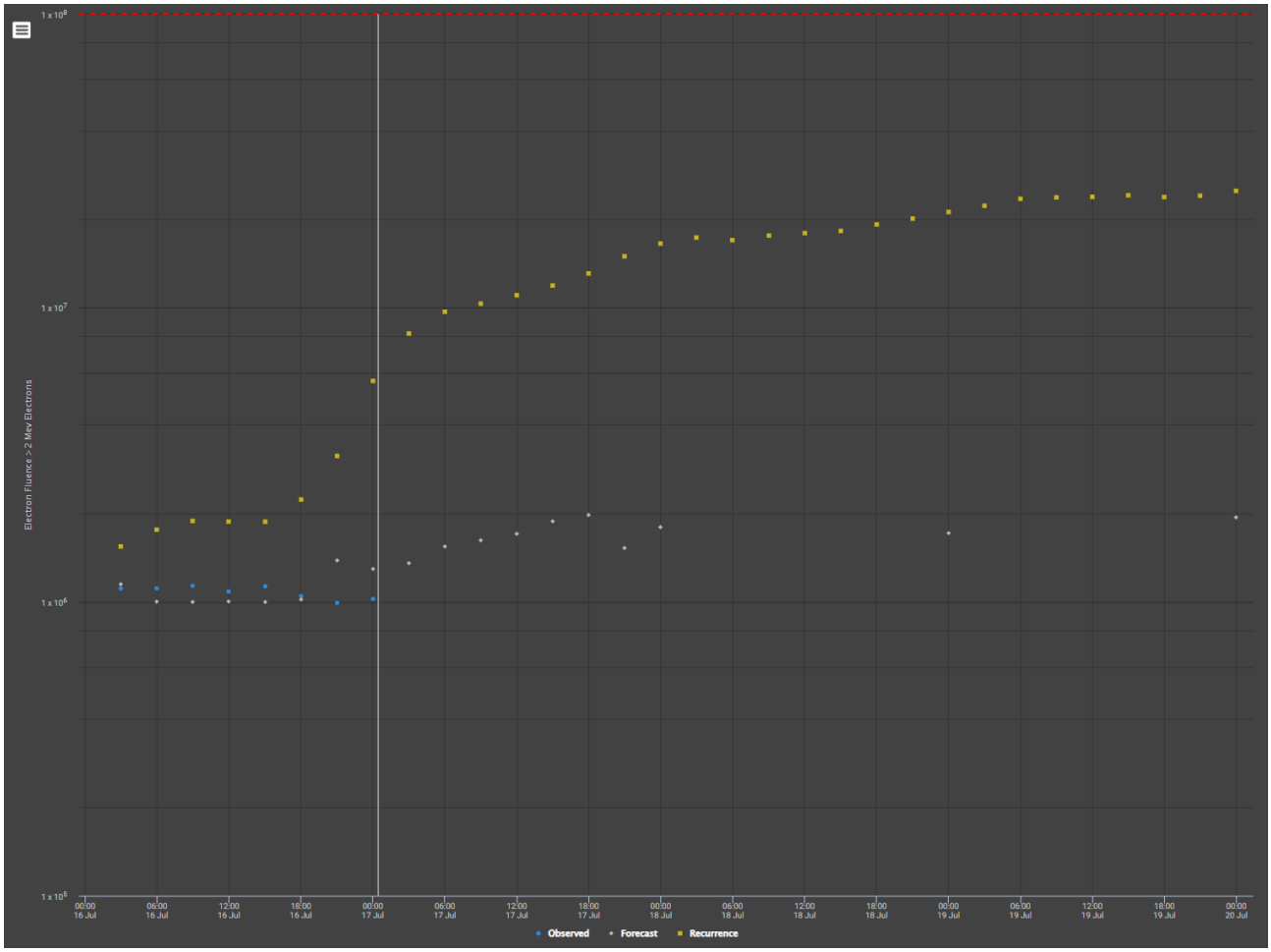
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux is expected to remain at background levels. This may change should the onset of any fast wind occur around day 2 or 3 (18-19 July). Any uptick in fluence may be experienced from day 3 or 4 (19-20 Jul) onward, though the expectation is to remain below the Active threshold.

MOSWOC REFM runs are considered to be offering reasonable guidance in their continuing flat forecast trend.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: MOSWOC REFM electron fluence forecast/observations/recurrence



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